Madison Public Schools

Physics - Unit 8 - Light

Unit Focus

Students will explore electromagnetic radiation with emphasis on visible light. They will begin by exploring electromagnetic radiation and its spectrum in order to correlate frequencies and wavelengths. They will also explore the relationship between the frequency of a wave and its energy and real life applications of this principle. They will further evaluate the relationship between frequency, wavelength and speed as quantitatively described in the wave equation. They will continue exploring light and electromagnetic radiation's Law of Reflection and will qualitatively explore the principle of refraction and how it manifests in real life in terms of color mixing, polarization and curved mirrors. If time allows, students will explore lenses as they relate to optical instruments and the functioning of the eye.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards (DCI)
Science: 11

- The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing. *PS4.9.A1*
- Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many features of electromagnetic radiation, and the particle model explains other features. *PS4.9.B1*
- When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells. *PS4.9.B3*

Student Growth and Development 21st Century Capacities Matrix
Critical Thinking

- Analyzing: Students will be able to examine information/data/evidence to make inferences and identify possible underlying assumptions, patterns,

Transfer

T1 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.

Meaning

Understanding(s)	Essential Question(s)
U1 When waves encounter objects they can reflect, refract, diffract or absorb depending on the property of material. **U2** Electromagnetic radiation can be represented by oscillating magnetic and electric fields (waves) or as photons (particles). **U3** Wavelength, frequency, and amplitude are properties of a wave that determine its characteristics such as pitch, color, sound and energy. **U4** Frequency of electromagnetic waves is directly proportional to its energy which can affect how it interacts with matter.	**Q1** Why are multiple models of light needed to explain its behavior? **Q2** Why are different forms of radiation used for different purposes? **Q3** How can I apply principles of physics to solve a novel problem?

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
K1 light may be represented by a wave or a particle based on observations made	**S1** calculate the wavelength, frequency or speed of an electromagnetic wave given 2 of the 3 variables

Stage 1: Desired Results - Key Understandings		
and relationships. *MM.1.2* *Creative Thinking* • Design: Students will be able to engage in an appropriate process to refine their product. *MM.2.3*	**K2** the electromagnetic spectrum is divided into subsegments based on the energy of the wave and the applications to society **K3** the speed of all electromagnetic waves is the same ; higher energy waves have higher frequencies and lower wavelengths **K4** light reflects off of surfaces; smooth surfaces cause images to form and rough surfaces do not **K5** optical instruments make use of the reflection and refraction of light **K6** light bends as it moves from one media to another due to the change of the speed of light in the media	**S2** calculate the angle of refraction of light **S3** determine the direction of bending of light based on the index of refraction of the media